

3577

**NOISE ASSESSMENT CRITERIA  
IN LAND USE PLANNING:**

**REQUIREMENTS, PROCEDURES  
AND IMPLEMENTATION**

**MAY 1997**



**Ministry of  
Environment  
and Energy**



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PIBS 3517E



# **Noise Assessment Criteria in Land Use Planning: Requirements, Procedures and Implementation**

October 1997

*This document provides technical details pertinent to MOE Guideline LU-131, Noise Assessment Criteria in Land Use Planning.*

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**1. SCOPE**

This document presents information relating to the details of technical assessment and review of noise impact on planned sensitive land uses. Specified are the conditions under which noise studies may be required, as well as the appropriate assessment methods and procedures. The control measures to be incorporated into the design of the development or the individual dwellings, which are required to enable compliance with the applicable noise criteria, are described as well as summarized in a tabular format.

**2. REFERENCES**

- [1] LU-131, Noise Assessment Criteria in Land Use Planning
- [2] ORNAMENT, Ontario Road Noise Analysis Method for Environment and Transportation, Technical Document, Ontario Ministry of the Environment, ISBN 0-7729-6376 (1989)
- [3] STEAM, Sound from Trains Environmental Analysis Method, Ontario Ministry of the Environment, ISBN 0-7729-6376-2 (1990)
- [4] NPC-216, Residential Air Conditioning Devices
- [5] Environmental Noise Guidelines for Installation of Residential Air Conditioning Devices, Ontario Ministry of the Environment, ISBN 0-7778-1616-4 (1994)

**3. DEFINITIONS**

The majority of terms are defined in LU-131, Reference [1]. Other terminology is defined by the following:

- For the purposes of the noise impact assessment in an Outdoor Living Area, the protected area should be not less than 56 m<sup>2</sup> (600 ft<sup>2</sup>) for single family dwellings, 46 m<sup>2</sup> (500 ft<sup>2</sup>) for semi-detached units and 37 m<sup>2</sup> (400 ft<sup>2</sup>) per unit for row housing.
- For the purposes of noise impact assessment in an Outdoor Living Area, the point of assessment is typically 3 m from the building facade and 1.5 m above ground.
- For the purposes of noise impact assessment in the plane of a bedroom window, the point of assessment is typically 4.5 m above ground unless the dwelling is a multi-storey building.
- The noise impact assessment in the Outdoor Living Area or in the plane of a window shall be performed in terms of a "free-field" sound level which is the sound level not affected by the presence of the building under assessment. The prediction methods ORNAMENT, Reference [2], and STEAM, Reference [3], yield the "free field" sound level.

**4. NOISE IMPACT STUDIES**

Feasibility or detailed noise impact studies may be required to support the development submissions. The objective of the feasibility study is to estimate the feasibility of the proposal in the context of site design and the extent of control measures such as barriers, ventilation requirements and building components. Feasibility studies should be submitted with the initial proposal.

The feasibility study should also assess the site layout including the roadways and orientation of the buildings, as well as allow for consideration of the appropriate zoning including industrial, commercial, high, low and medium density residential use. The study should alert the proponent and the approving agency of potential

land use conflicts as well as determine the practicality and economic feasibility of physical noise control measures, in conjunction with the selected site design. Furthermore, the study should provide a clear direction regarding the need for additional studies and the timing associated with the implementation of required control measures.

The purpose of the detailed study is to assess the impact of all noise sources affecting the subject lands and determine the appropriate layout, design and required control measures. The study report should include details of assessment methods, summarize the results and recommend the required outdoor as well as indoor control measures. The requirement for a detailed noise study may be a condition of initial approval of the proposed development; however, detailed studies may be prepared and submitted in place of feasibility studies.

Noise impact studies should be prepared by a qualified individual, preferably a Professional Engineer with experience in environmental acoustics.

#### **4.1 AIRCRAFT NOISE**

A detailed noise study is required for proposals that are located at or above NEF/NEP 25. The study should be submitted with the initial proposal. It should be noted that certain airport facilities and activities are considered as stationary sources of noise, see Section 4.3.

#### **4.2 SURFACE TRANSPORTATION NOISE**

##### **4.2.1 Feasibility Noise Studies**

Typical conditions under which a feasibility study is required are given below. The primary condition is that:

- The sound levels resulting from surface transportation noise affecting the proposed lands exceed the noise criteria by more than 10 dBA.

Alternatively, the requirement for a feasibility study may be defined in terms of a setback distance from the noise source. The following setback distances are guidelines as they may vary depending on individual site specific conditions, particularly topography.

- The proposed lands are within 100 m from a freeway right-of-way or 50 m from a provincial highway right-of-way;
- The proposed lands are within 100 m from a Principal Main Railway Line right-of-way or 50 m from a Secondary Main Railway Line right-of-way.

Irrespective of the above conditions, it is in the interest of the proponent to perform a feasibility study in the early planning stages.

##### **4.2.2 Detailed Noise Studies**

Typical conditions under which a detailed study is required are given below. The primary condition is that:

- The sound levels resulting from surface transportation noise affecting the proposed lands exceed the noise criteria by more than 5 dBA.

Alternatively, the requirement for a detailed study may be defined in terms of a setback distance from the noise source. The following setback distances are guidelines as they may vary depending on individual site specific conditions, particularly the presence of built-up areas or individual structures and topography.



- The proposed lands are within 500 m from a freeway right-of-way, 250 m from a provincial highway, or 100 m from the right-of-ways of other roads;
- The proposed lands are within 500 m from a Principal Main Railway Line, 250 m from a Secondary Main Railway Line, or 100 m from other railway lines.

#### 4.3 NOISE FROM STATIONARY SOURCES

The category of stationary noise sources includes individual equipment and extended facilities such as industrial facilities, aggregate extraction facilities, sewage treatment facilities, ancillary transportation facilities and commercial facilities, see Annex to LU-131, Reference [1]. Feasibility as well as detailed noise studies are generally required whenever the proposed lands are within the influence area of a stationary noise source. The extent of the influence area is case specific, depending on factors such as the type and scale of the stationary source, intervening topography and intervening land uses. In general, it is in the interest of the proponent to perform a feasibility study.

### 5. ROAD NOISE CONTROL MEASURES

#### 5.1 OUTDOOR LIVING AREAS

The sound level,  $L_{eq}$  is determined using the ORNAMENT, Reference [2], prediction method during the daytime hours of 0700-2300. If the sound level,  $L_{eq}$  in the Outdoor Living Area is less than or equal to 55 dBA, no control measures are required.

If the sound level,  $L_{eq}$  in the Outdoor Living Area is greater than 55 dBA and less than or equal to 60 dBA, physical control measures may be applied to reduce the sound level to 55 dBA. If no physical measures are provided, prospective purchasers or tenants shall be informed of potential noise problems by a warning clause (Type A).

If the sound level,  $L_{eq}$  in the Outdoor Living Area is greater than 60 dBA, control measures are required to reduce the level to 55 dBA. Only in cases where the required physical noise control measures are proven not to be technically, economically, or administratively feasible, such as contravening local by-laws, would an excess not greater than 5 dBA above the criterion (55 dBA) be acceptable with a warning clause Type B. When required, control measures should be designed to reduce the sound level to the criterion of 55 dBA.

##### 5.1.1 Noise Barriers

If a barrier is used as a noise control measure, its height must be such that the line of sight between the source and the receiver is obstructed. It is required that the surface density of the noise barrier be a minimum of 20 kg/m<sup>2</sup>. It is further required that the barrier be designed and constructed without cracks or gaps. Any gaps under the noise barrier that are necessary for drainage purposes must be minimized and localized, and must not deteriorate the acoustical performance.

#### 5.2 PLANE OF A WINDOW - VENTILATION REQUIREMENTS

The requirements are applied within two time periods.

##### 5.2.1 Night-time Period, 2300 - 0700 Hours

The sound level is determined through the ORNAMENT, Reference [2], prediction method at the plane of bedroom windows.

Control measures are not required if the  $L_{eq}$ (8 hour) night-time sound level in the plane of a bedroom window is less than or equal to 50 dBA. If the sound level in the plane of a bedroom window is greater than 50 dBA and less than or equal to 60 dBA, it is required to design the dwelling with a provision for future installation of central air conditioning. This requirement usually implies forced air heating with the ducts sized for central air conditioning. Warning clause Type C is also required.

If the night-time sound level in the plane of a bedroom window is greater than 60 dBA, installation of central air conditioning is mandatory with a warning clause Type D. In addition, building components including windows, walls and doors, where applicable, must be designed so that the indoor sound levels comply with the noise criteria in Table 7. The location and installation of the outdoor air conditioning device should comply with noise criteria of NPC-216, Reference [4], and guidelines of the Environmental Noise Guidelines for Installation of Residential Air Conditioning Devices, Reference [5].

### 5.2.2 Day-time Period, 0700 - 2300 Hours

The sound level is determined through the ORNAMENT, Reference [2], prediction method at the plane of living/dining room windows.

Control measures are not required if the  $L_{eq}$ (16 hour) day-time sound level in the plane of a living/dining room window is less than or equal to 55 dBA. If the sound level in the plane of a living/dining room window is greater than 55 dBA and less than or equal to 65 dBA, it is required to design the dwelling with a provision for future installation of central air conditioning. This requirement usually implies forced air heating with the ducts sized for central air conditioning. Warning clause Type C is also required.

If the day-time sound level in the plane of a living/dining room window is greater than 65 dBA, installation of central air conditioning is mandatory with a warning clause Type D. In addition, building components including windows, walls and doors, where applicable, must be designed so that the indoor sound levels comply with the noise criteria in Table 7. The location and installation of the outdoor air conditioning device should comply with noise criteria of NPC-216, Reference [4], and guidelines of the Environmental Noise Guidelines for Installation of Residential Air Conditioning Equipment, Reference [5].

## 5.3 INDOOR LIVING AREAS - BUILDING COMPONENTS

The sound level,  $L_{eq}$  during the day-time (16 hour) and night-time (8 hour) periods is determined using the ORNAMENT, Reference [2], prediction method, immediately outside the dwelling envelope.

If the night-time sound level outside the bedroom windows exceeds 60 dBA or the day-time sound level outside the living/dining area windows exceeds 65 dBA, building components including windows, walls and doors, where applicable, must be designed so that the indoor sound levels comply with the noise criteria in Table 7. The acoustical performance of the building components (windows, doors and walls) must be specified.

## 6. RAIL NOISE CONTROL MEASURES

### 6.1 OUTDOOR LIVING AREAS

Whistle noise is not included in the determination of the outdoor day-time sound level. Otherwise, with the exception that the STEAM, Reference [3], prediction method is used to determine the rail traffic sound levels, all the provisions of Section 5.1 apply also to noise control requirements for rail noise.

## 6.2 PLANE OF A WINDOW - VENTILATION REQUIREMENTS

Whistle noise is not included in the determination of the sound level in the plane of a window. Otherwise, with the exception that the STEAM, Reference [3], prediction method is used to determine the rail traffic sound levels, all the provisions of Section 5.2 apply also to noise control requirements for rail noise.

## 6.3 INDOOR LIVING AREAS - BUILDING COMPONENTS

The sound level,  $L_{eq}$  during the day-time (16 hour) and night-time (8 hour) periods is determined using the STEAM, Reference [3], prediction method immediately outside the dwelling envelope. Whistle noise is included in the determination of the sound level.

If the night-time sound level outside the bedroom windows exceeds 55 dBA or the day-time sound level outside the living/dining area windows exceeds 60 dBA, building components including windows, walls and doors, where applicable, must be designed so that the indoor sound levels comply with the noise criteria in Table 7. The acoustical performance of the building components (windows, doors and walls) must be specified.

In addition, the following requirement applies:

The exterior walls of the first row of dwellings next to the railway tracks shall be built to a minimum of EW5 (brick veneer) or equivalent construction from the foundation to the rafters when the rail traffic  $L_{eq}$  (24 hour), estimated at a location of night time receptor, is greater than 60 dBA and when the first row of dwellings are within 100 m of the tracks.

**Note:** EW5 is an exterior wall composed of 12.7 mm gypsum board, vapour barrier and 38 x 89 mm studs with 50 mm (or thicker) mineral wool or glass fibre batts in inter-stud cavities plus sheathing, 25 mm air space and 100 mm brick veneer.

## 7. COMBINATION OF ROAD AND RAIL NOISE

The noise impact in the OLA and in the plane of a window, and the requirements for outdoor measures, ventilation measures and warning clauses, shall be determined by combining road and rail traffic sound levels.

The assessment of the indoor sound levels and the resultant requirement for the acoustical descriptors, AIF or STC, of the building components shall be performed separately for road and rail noise. The resultant acoustical descriptors, AIF or STC, shall subsequently be combined to determine the required components.

## 8. AIRCRAFT NOISE CONTROL MEASURES

The noise impact from aircraft is assessed using the NEF/NEP contour maps. The NEF/NEP contour values are approved by Transport Canada for various airports in Canada.

If the receptor location is within the NEF/NEP contours of 25 and 30, it is required to design the dwelling with a provision for central air conditioning. This requirement usually implies forced air heating with the ducts sized for future installation of central air conditioning. In addition, building components including windows, doors, walls and ceiling/roof must be designed to achieve the indoor sound level criteria. Warning clause C is also required.

If the receptor location is within the NEF/NEP contours of 30 and 35, central air conditioning is mandatory with a warning clauses Type B and D. In addition, building components including windows, doors, walls and ceiling/roof must be designed to achieve the indoor sound level criteria.

**9. COMBINATION OF ROAD, RAIL AND AIRCRAFT NOISE**

The noise impact in the OLA and in the plane of a window, and the requirements for outdoor measures, ventilation measures and warning clauses, shall be determined separately for surface transportation and aircraft noise. Surface transportation impact shall be performed by combining road and rail traffic sound levels.

The assessment of the indoor sound levels, and the requirements for the acoustical performance of building components, shall be performed separately for road noise, rail noise and aircraft noise. The resultant acoustical descriptors, such as AIF or STC, shall be subsequently combined to determine the overall acoustical descriptor. Selection of the required components shall be based on the overall descriptor.

**10. CONTROL MEASURES FOR STATIONARY SOURCES**

The assessment of noise impact produced by stationary sources and any resultant control measures is more complex than that of transportation sources. The following is a brief and simplified summary of the requirements. Annex to Publication LU-131, Reference [1], provides additional details.

The sound level,  $L_{eq}$  (1 hour), at a point of reception is determined during day-time and night-time hours either through prediction methods or from measurements. If the sound level in any given hour exceeds the applicable criteria, summarized in Table 7, control measures are required.

When control measures are required, they are expected to reduce the sound level to the applicable criteria at all the points of reception within the proposed development. The noise impact may be controlled at the source or at the receptor; typically, the available control measures consist of noise barriers, erected on the property of the sensitive land use, or "at-the-source" control measures such as silencers, mufflers or enclosures. Preferably, the control should be implemented at the source in order to reduce the noise emissions.

Warning clauses that are used in place of physical control measures to identify an excess over the Ministry criteria are not acceptable. Warning clause (Type E) for stationary sources may identify a potential concern due to the juxtaposition of the facility but must not be utilized to justify an excess over the criteria.

**11. STATIONARY AND TRANSPORTATION SOURCES**

The required control measures for transportation and stationary sources should be evaluated separately for day-time and night-time periods. The final selection of control measures should ensure the compliance with the applicable sound level criteria of this document.

**12. CENTRAL AIR CONDITIONING**

Central air conditioning is required in order to ensure that the windows may remain closed. The ventilation system must provide temperature and humidity control and must not generate sound levels that exceed the applicable indoor sound level criteria.

In the majority of situations, particularly for single family dwellings, central air conditioning is the only ventilation system that satisfies the above conditions. However, in high and medium density residential developments, other forms of mechanical ventilation may be available. Ventilation methods other than central air conditioning are acceptable for high and medium density residential developments, subject to the following conditions:

- (a) the noise produced by the proposed ventilation system complies with the indoor noise criteria of Table 7. In practice, this condition usually implies that window air conditioning units are not acceptable;
- (b) the ventilation system complies with all national, provincial or municipal standards and codes;

- (c) the ventilation system is designed by a Professional Engineer expert in heating and ventilation;
- (d) the ventilation system enables the windows and exterior doors to remain closed.

### 13. PROVISION FOR CENTRAL AIR CONDITIONING

Provision for central air conditioning is required in order to allow central air conditioning to be installed in the future, and enable windows to remain closed.

In the majority of situations, particularly for single family dwellings, provision for central air conditioning implies forced air heating with the ducts sized for the future installation of central air conditioning. However, in high and medium density residential developments, other forms of heating and mechanical ventilation may be available. Ventilation methods other than forced air heating and central conditioning are acceptable for high and medium density residential developments, subject to the conditions outlined in Section 12. The main condition is that the noise produced by the proposed ventilation system complies with the indoor noise criteria of Table 7. In practice, this condition implies that window air conditioning units are not acceptable.

### 14. WARNING CLAUSES

#### 14.1 TRANSPORTATION SOURCES

The following warning clauses may be used individually or in combination:

##### TYPE A:

"Purchasers/tenants are advised that sound levels due to increasing road (rail) (air) traffic may occasionally interfere with some activities of the dwelling occupants as the sound levels exceed the Municipality's and the Ministry of the Environment's noise criteria."

##### TYPE B:

"Purchasers/tenants are advised that despite the inclusion of noise control features in the development and within the building units, sound levels due to increasing road (rail) (air) traffic may on occasions interfere with some activities of the dwelling occupants as the sound levels exceed the Municipality's and the Ministry of the Environment's noise criteria."

##### TYPE C:

"This dwelling unit has been fitted with a forced air heating system and the ducting, etc. was sized to accommodate central air conditioning. Installation of central air conditioning by the occupant will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the Municipality's and the Ministry of the Environment's noise criteria. (Note: The location and installation of the outdoor air conditioning device should be done so as to comply with noise criteria of MOE Publication NPC-216, Residential Air Conditioning Devices and thus minimize the noise impacts both on and in the immediate vicinity of the subject property.)"

##### TYPE D:

"This dwelling unit has been supplied with a central air conditioning system which will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the Municipality's and the Ministry of the Environment's noise criteria."

**14.2 STATIONARY SOURCES**
**TYPE E:**

"Purchasers are advised that due to the proximity of the adjacent industry (facility) (utility), sound levels from the industry (facility) (utility) may at times be audible."

**15. VERIFICATION OF NOISE CONTROL MEASURES**

Implementation of noise control measures should be verified (certified) by a qualified individual, preferably a Professional Engineer with experience in environmental acoustics.

**16. SUMMARY OF MINIMUM NOISE CONTROL AND VENTILATION REQUIREMENTS FOR ROAD, RAIL AND AIRCRAFT NOISE**

**TABLE 1**  
**COMBINATION OF ROAD AND RAIL NOISE, DAY-TIME (0700 - 2300)**  
**OUTDOOR, VENTILATION AND WARNING CLAUSE REQUIREMENTS**

ASSESSMENT LOCATION	$L_{eq}$ (16 hr) (dBA)	VENTILATION REQUIREMENTS	OUTDOOR CONTROL MEASURES	WARNING CLAUSE
OUTDOOR LIVING AREA (OLA)	Less than or equal to 55 dBA	N/A	None required	Not required
	Greater than 55 dBA to less than or equal to 60 dBA	N/A	Control measures (barriers) not required but should be considered	Required if resultant $L_{eq}$ exceeds 55 dBA Type A
	Greater than 60 dBA	N/A	Control measures (barriers) required to reduce the $L_{eq}$ to below 60 dBA and as close to 55 dBA as technically, economically and administratively feasible	Required if resultant $L_{eq}$ exceeds 55 dBA Type B
PLANE OF LIVING ROOM WINDOW	Greater than 50 dBA to less than or equal to 55 dBA	None required	N/A	Not required
	Greater than 55 dBA to less than or equal to 65 dBA	Forced air heating with provision for central air conditioning	N/A	Required Type C
	Greater than 65 dBA	Central air conditioning	N/A	Required Type D

**TABLE 2**  
**COMBINATION OF ROAD AND RAIL NOISE, NIGHT-TIME (2300 - 0700)**  
**VENTILATION AND WARNING CLAUSE REQUIREMENTS**

ASSESSMENT LOCATION	$L_{eq}$ (8 hr) (dBA)	VENTILATION REQUIREMENTS	WARNING CLAUSE
PLANE OF BEDROOM WINDOW	Greater than 50 dBA to less or equal to 60 dBA	Forced air heating with provision for central air conditioning	Required Type C
	Greater than 60 dBA	Central air conditioning	Required Type D

**TABLE 3**  
**ROAD AND RAIL NOISE, DAY-TIME (0700 - 2300)**  
**BUILDING COMPONENT REQUIREMENTS**

ASSESSMENT LOCATION		$L_{eq}$ (16 hr)	BUILDING COMPONENT REQUIREMENTS
PLANE OF LIVING ROOM WINDOW	ROAD	Less than or equal to 65 dBA	Building compliant with the Ontario Building Code
		Greater than 65 dBA	Building components (walls, windows, etc.) must be designed to achieve indoor sound level criteria
	RAIL	Less than or equal to 60 dBA	Building compliant with the Ontario Building Code
		Greater than 60 dBA	Building components (walls, windows, etc.) must be designed to achieve indoor sound level criteria

**TABLE 4**  
**ROAD AND RAIL NOISE, NIGHT-TIME (2300 - 0700)**  
**BUILDING COMPONENT REQUIREMENTS**

ASSESSMENT LOCATION		$L_{eq}$ (8 hr)	BUILDING COMPONENT REQUIREMENTS
PLANE OF BEDROOM WINDOW	ROAD	Less than or equal to 60 dBA	Building compliant with the Ontario Building Code
		Greater than 60 dBA	Building components (walls, windows, etc.) must be designed to achieve indoor sound level criteria
	RAIL	Less than or equal to 55 dBA	Building compliant with the Ontario Building Code
		Greater than 55 dBA	Building components (walls, windows, etc.) must be designed to achieve indoor sound level criteria

**TABLE 5**  
**AIRCRAFT NOISE - 24 HOURS**

ASSESSMENT LOCATION	NEF OR NEP	VENTILATION REQUIREMENTS	NOISE CONTROL REQUIREMENTS	WARNING CLAUSE
ANY LOCATION ON PROPERTY OR LOT	Less than NEF 25	None required	Building compliant with the Ontario Building Code	Not required
	Greater or equal to NEF 25 to less than NEF 30	Provision for central air conditioning	Building components (walls, windows, etc.) must be designed to achieve indoor sound level criteria	Required Type C
	Greater than NEF 30	Central air conditioning	Building components (walls, windows, etc.) must be designed to achieve indoor sound level criteria	Required Type B and D

**TABLE 6**  
**FACADE REQUIREMENT FOR RAIL NOISE ONLY - 24 HOURS**

ASSESSMENT LOCATION	DISTANCE TO RAILWAY (m)	$L_{eq}$ (24 hr) (dBA)	NOISE CONTROL REQUIREMENT
PLANE OF BEDROOM WINDOW	Less than 100 m	Less than or equal to 60 dBA	No additional requirement
		Greater than 60 dBA	Brick veneer or acoustically equivalent
	Greater than 100 m	Less than or equal to 60 dBA	No additional requirement
		Greater than 60 dBA	No additional requirement



17. LU-131 NOISE CRITERIA SUMMARY

**TABLE 7**  
**SUMMARY OF NOISE CRITERIA FOR SENSITIVE DEVELOPMENTS**

Receiver Category			Time Period		Source Type							
					Road Traffic		Rail Traffic		Aircraft		Stationary	
					Criterion		Criterion		Criterion		Criterion	
					Averaged over Time Period		Averaged over Time Period		Averaged over 24 Hours		Averaged over any Hour during Time Period	
			L <sub>eq</sub>	Applies	L <sub>eq</sub>	Applies at	NE	Applies at	L <sub>eq</sub>	Applies at		
Outdoor	Class 1	0700-2300	55 <sup>1</sup>	OLA	55 <sup>1,4</sup>	OLA	302	ANYWHERE ON PROPERTY	50 <sup>3</sup>	OPOR		
		2300-0700	-		-				-			
	Class 2	0700-1900	55 <sup>1</sup> (16 hr)	OLA	55 <sup>1,4</sup> (16 hr)	OLA	302	ANYWHERE ON PROPERTY	50 <sup>3</sup>	OPOR		
		1900-2300							45 <sup>3</sup>	OPOR		
		2300-0700							-		-	
	Plane of Window	Class 1	0700-2300	-		-		-		50 <sup>3</sup>	POW	
2300-0700			-		-		45 <sup>3</sup>			POW		
Class 2		0700-1900	-		-		-		50 <sup>3</sup>	POW		
		1900-2300							45 <sup>3</sup>	POW		
		2300-0700							-		-	
Indoor <sup>6</sup>		Class 1 & 2	0700-2300	45	Living Quarters	40 <sup>5</sup>	Living Quarters	5	Living Quarters	· <sup>7</sup>	Living Quarters	
	2300-0700		40	Sleeping Quarters	35 <sup>5</sup>	Sleeping Quarters	0	Sleeping Quarters	· <sup>7</sup>	Sleeping Quarters		

## NOTES:

<sup>1</sup> The criterion may be exceeded by an amount not greater than 5 dBA, subject to justification and use of a Warning Clause.

<sup>2</sup> Redevelopment of existing residential uses and other sensitive land uses or infilling of residential and other sensitive land uses may be considered above 30 NEF/NEP if it has been demonstrated that there will be no negative impacts on the long term function of the airport. This is subject to implementation of appropriate control measures including a Warning Clause.

<sup>3</sup> or Hourly L<sub>eq</sub> of road traffic, whichever is higher.

- <sup>4</sup> Whistle noise excluded.
- <sup>5</sup> Whistle noise included.
- <sup>6</sup> Other guidelines for offices, hotels, places of worship, stores, etc. are contained in Annex to LU-131, Reference [1].
- <sup>7</sup> Compliance with the plane-of-window criteria should ensure that the indoor sound levels are acceptable. Special care must be exercised with some sources.

**DEFINITIONS:**

**OLA** means Outdoor Living Area

**POW** means Plane of Window

**OPOR** means Outdoor Point of Reception



